Best shielding material for a Faraday cage against 36kHz electric fields?

Asked 2 years, 11 months ago Modified 2 years, 3 months ago Viewed 1k times

1

I have a room aka cuboid with 4 x 3 x 2.5 meters. In the 3D center is a device under test. To shield against 36kHz electric fields I want to build a Faraday cage.

I learned the hard way that aluminium foil does not really work so I am asking now what is a better material.

Is a 2mm diameter copper wire at all edges worth a try ? It is 7 skin depths thick and the holes (biggest is 4 x 3 meters) are considerably smaller than wavelength.

Is there a better material for this purpose?

shielding faraday-cage electric-field

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edited Jun 29, 2021 at 17:48

JRE
71.9k ● 10 ● 108 ● 192

asked Jun 28, 2021 at 19:46

Hansebenger
123 ● 7

Gold is more conductive, so slightly better. Copper is fine. I'd also try and avoid sharp corners of any kind. So I'd try to tessellate the interior of your cuboid. – jonk Jun 28, 2021 at 19:55

Gold is a bit too expensive to be considered. I think I will start with no tesselation and then tesselate near the edges to "round" the corners. – Hansebenger Jun 28, 2021 at 20:01

I'd want to completely avoid the corners with whatever is done. They are problematic. (They love to re-radiate in crazy ways.) Just avoid sharp, pointy things! ;) Maybe use diamond shapes on each surface (rotate by 90 degrees?) but also round things near the joints. – jonk Jun 28, 2021 at 20:03

Nah. Use ovals. Should have thought of that, earlier. – jonk Jun 28, 2021 at 20:12

1 @jonk Gold is less conductive than copper. As pure elements, silver is most conductive, followed by copper, then gold, then aluminum. – Hearth Jun 29, 2021 at 18:17

2 Answers

Sorted by: Highest score (default)

2

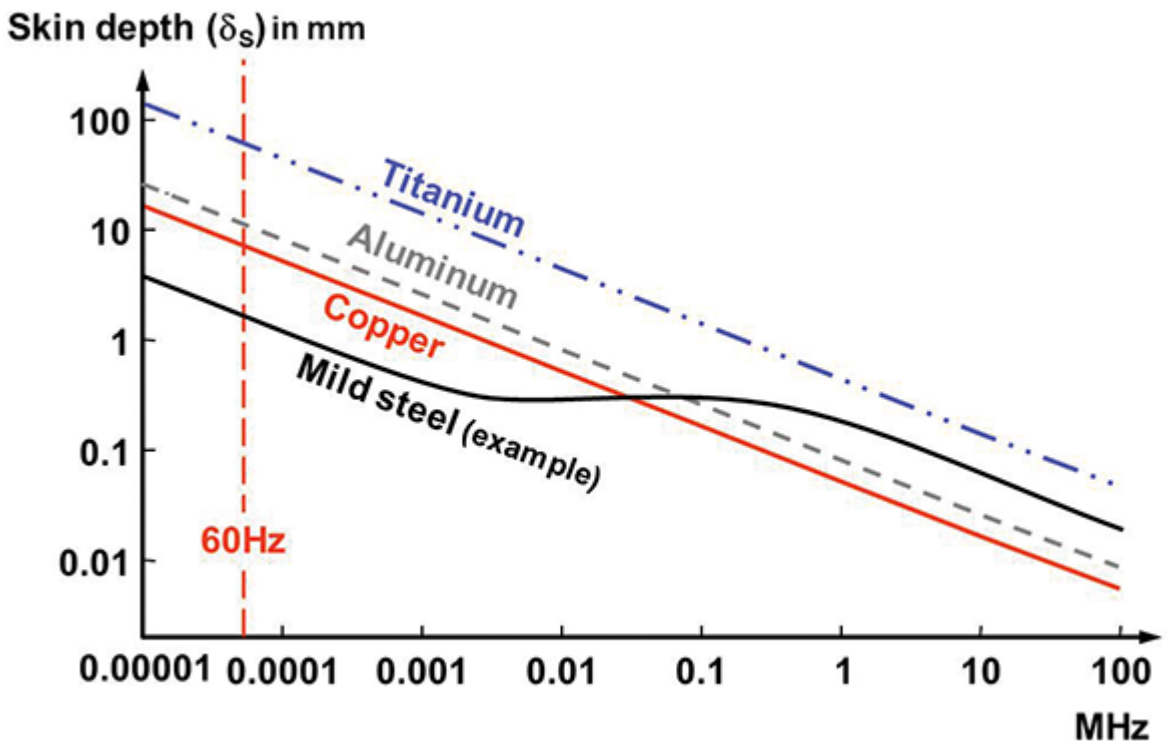
For a faraday cage, the material needs to be able to conduct the high frequency EM wave around whatever is shielded. The material also needs sufficient thickness to attenuate it, one figure for surface wave propagation in a material is skin depth (below the skin depth there is little or no propagation from an incoming wave into the material). The skin depth for aluminum is about 1mm at 37kHz which means to get a good amount of attenuation (~130dB) you would need about 1mm of aluminum which is much thicker than an aluminum foil.

Make your shield thicker, or switch materials.

As far as the concern with apertures, the general equation for attenuation through the aperture is this:

$$S = \log \frac{\lambda}{2l}$$

Where l is the length and λ is the wavelength. Make the slot smaller than half of the wavelength of the frequencies you want to shield.



Source: https://incompliancemag.com/article/skin-effect-and-surface-currents/

I am sorry for not accepting this answer: 1) You are answering more my former question (electronics.stackexchange.com/questions/573084/…) 2) The answer is very genereic for things I have already respected in my question and doesn't compare the proposed 1mm thick solid aluminium to the 2mm thick copper wire I proposed – Hansebenger Jun 29, 2021 at 17:15

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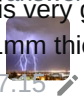
answered Jun 28, 2021 at 20:17



Voltage Spike ♦

83.6k ● 44 ● 84 ● 222

0

2mm diameter copper wire at all edges is worse than the aluminium foil because it covers less area, which is all that matters for electrically small Faraday cages: https://people.maths.ox.ac.uk/trefethen/chapman_hewett_trefethen.pdf

Simply cover more area with aluminium foil or use chicken wire.

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answered Mar 5, 2022 at 14:10

Hansebenger

123 ● 7